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ABSTRACT

First Steps is a program instituted by the Western Australia Ministry of Education to improve the literacy and numeracy of primary school students, particularly those at risk of academic failure. First Steps is organized around reading, writing, spelling, and oral language; children's skills are organized along developmental continua. These continua are an ordered series of statements describing behaviors children display as they move toward literacy. The Spelling Developmental Continuum was revised as a response to a study of teacher assessments of the applicability of the continuum to their students and to teacher responses to a questionnaire about the continuum. The revised version was studied, and a revalidation study showed great improvements in the wording and acceptance of the continuum. This report describes, in detail, the changes made to the 1992 version of the Spelling Development Continuum, and records the effects of these changes as measured in the revalidation of the continuum. The 1993 revision seems to tap spelling ability better than the prior version did, and it groups indicators into phrases with improved precision. In addition, the item response theory methodology was useful in improving the Spelling Development Continuum. An appendix contains the indicator code numbers and text for both versions of the continuum. (SLD)

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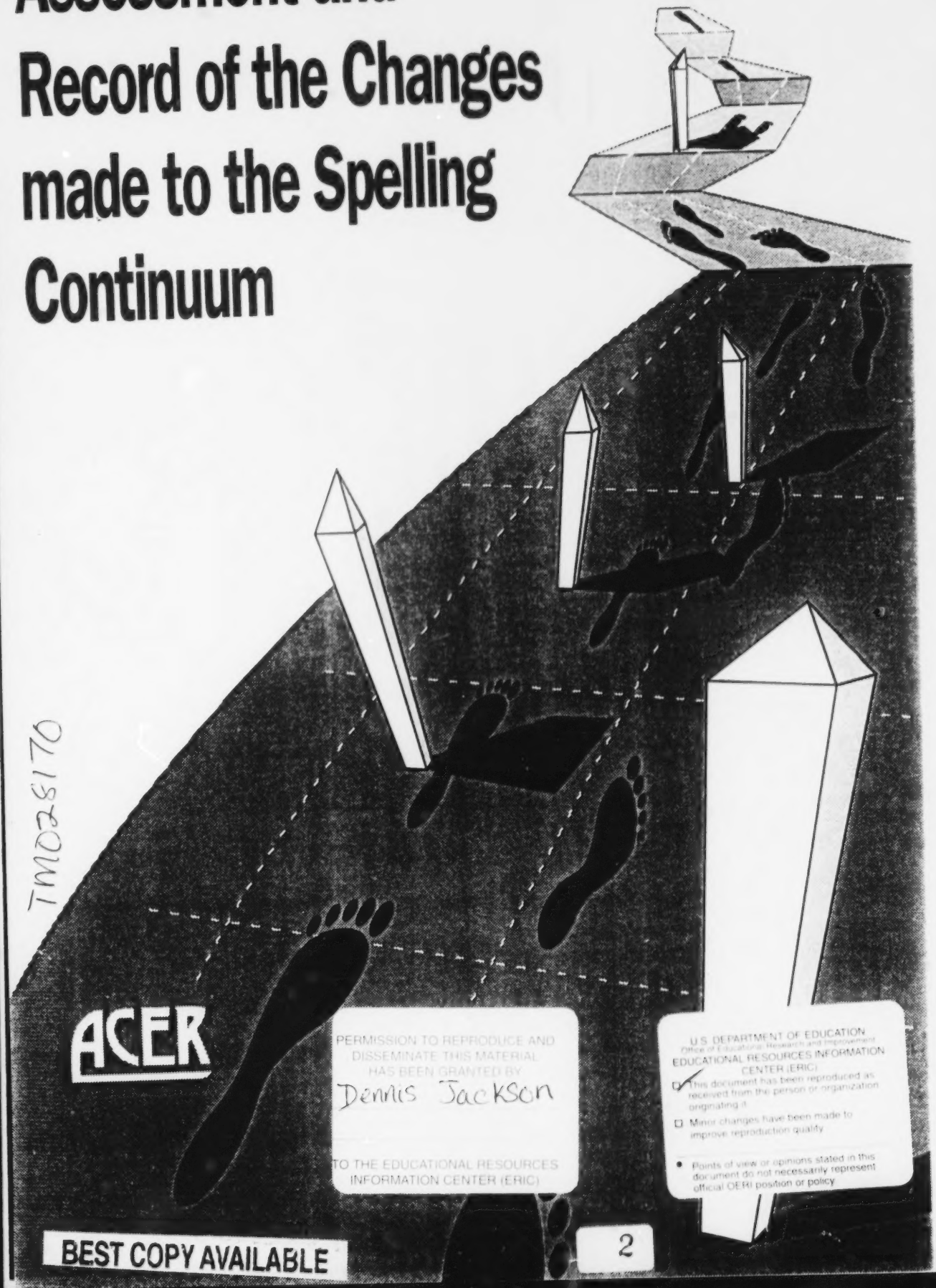
Assessment and Record of the Changes made to the Spelling Continuum



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A DESCRIPTION AND AN ASSESSMENT OF THE CHANGES MADE TO THE 1992 VERSION OF THE FIRST STEPS SPELLING DEVELOPMENT CONTINUUM AND AN ASSESSMENT OF THE ROLE OF ITEM RESPONSE THEORY IN THESE CHANGES

Report to the
Curriculum Development Branch
Western Australian Ministry of Education

ACER

Australian Council for Educational Research, January 1994.

SUMMARY OF THE MAIN FINDINGS

1. Generally, rewording indicators with a poor Infit Mean Square has led to an improvement in the Infit Mean Square of these indicators.

2. The 1993 version of the First Steps Spelling Development Continuum more consistently taps spelling ability than the 1992 version, probably as a result of the changes made to the text of some indicators.

3. The 1993 version of the First Steps Spelling Developmental Continuum groups indicators into phases with improved precision. There is less overlap between phases for both indicators and key indicators.

4. Item Response Theory seems to have been useful in helping to improve the First Steps Spelling Developmental Continuum.

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Appendix Indicator code numbers and text, with identification of indicators with poor Infit Mean Square and extreme difficulty for 1992 and 1993 versions of the First Steps Spelling Developmental Continuum. The appendix is printed on pink paper.

Editor's Note

This document is one of a series of reports that document the formative research that supported the creation and development of *First Steps*™. As a result of this research, the Education Department of Western Australia (EDWA), in collaboration with the Australian Council for Educational Research (ACER) revised *First Steps* in response to each of the issues and questions raised by this research. *First Steps* training courses, Developmental Continua, and Resource Books are published with due amendments and alterations.

Other research documents that support the development of *First Steps* include:

Dr. Phil Deschamp:

- A Survey of the Implementation of the Literacy Component of the *First Steps* Project in WA
- The Implementation of The Literacy Component of The *First Steps* Project in ELAN Schools
- A Survey of the Effectiveness of the Focus Teacher 'B' Training for the *First Steps* Project
- Student Achievement: A Study of the Effects of *First Steps* Teaching on Student Achievement
- Case Studies of The Implementation of the *First Steps* Project in Twelve Schools
- The Development and Implementation of the *First Steps* Project in Western Australia

ACER:

- Empirical Validation of the *First Steps* Reading Continuum
- Empirical Validation of the *First Steps* Spelling and Writing Continua
- Empirical Re-Validation of the *First Steps* Spelling Continuum
- Assessment and Record of the Changes made to the Spelling Continuum
- The Impact of *First Steps* on Schools and Teachers
- The Impact of *First Steps* on the Reading and Writing Ability of Year 5 Students
- Background: *First Steps* and the ACER Evaluation & Report on the Validity of the *First Steps* Writing and Spelling Continua*

EDWA:

- Supporting Linguistic and Cultural Diversity Through *First Steps:* The Highgate Project

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In 1992 the Australian Council for Educational Research began an evaluation of aspects of the First Steps project. One part of this evaluation involved the empirical validation of the Spelling Developmental Continuum. Item Response Theory analyses were used to inform the this validation, and the subsequent revision of the Spelling Developmental Continuum.

The validation found that the Spelling Developmental Continuum, in general, validly depicted the development of children's spelling competencies. However a number of minor, and two major problems were identified. The two major problems were that the indicators in the Transitional phase and the key indicators in the Phonetic phase were generally less difficult than the indicators and key indicators (respectively) in the developmentally earlier phases preceding them.

In response to these and other less pressing problems that were identified, the First Steps project re-examined some of the indicators and proposed new wordings (and other changes) to try and make the meaning of particular indicators clearer and to give greater coherence to the Continuum as a whole. ACER was then asked to re-validate this newly worded Spelling Continuum. This re-validation was conducted in November 1993. The main findings from this re-validation can be found in the report *Empirical re-validation of the First Steps Spelling Continuum*. The re-validation showed that there had been a general improvement in the Continuum as a result of the changes made to the earlier version. The effect of these changes was not discussed in great detail in the *Empirical re-validation of the First Steps Spelling Continuum* report because the main aim of the report was to assess, in general, the new version of the Spelling Development Continuum.

It was felt that a more systematic record of the changes made to the earlier version of the Spelling Development Continuum and the outcomes for each indicator that had been changed, was needed. Such a record would be of use to First Steps. It may also assist in evaluating Item Response Theory as a method for informing the revision of Developmental Continua such as those produced by First Steps.

Throughout this report the earlier version of the First Steps Spelling Developmental Continuum is named the 1992 version. The Spelling Developmental Continuum with the changed indicators is known as the 1993 version.

Aims of this report

This report aims to describe, in detail, the changes made to the 1992 version of the Spelling Development Continuum, and to record the effect of these changes as

measured in the re-validation of the Continuum. It also aims to provide an assessment of these changes.

The research questions

The following specific questions are addressed in this report:

- Which First Steps indicators with a poor Infit Mean Square[1] in the 1992 version improved in the 1993 version of the Spelling Development Continuum?
- Which First Steps indicators with a good Infit Mean Square in the 1992 version now have da poor value in the 1993 version of the Spelling Development Continuum?
- Which First Steps indicators with an extreme estimate of difficulty (compared with other indicators within the phase) in the 1992 version, improved in the 1993 version of the Spelling Development Continuum?[2]
- Which First Steps indicators with an appropriate estimate of difficulty in the 1992 version are now outliers in the 1993 version of the Spelling Development Continuum?
- What patterns are there in the changes to the wording of indicators which may suggest an explanation for the changes observed in the 1993 version of the Spelling Development Continuum?
- Overall, from the perspective of Item Response Theory, to what extent has the Spelling Developmental Continuum been improved upon with the rewording of indicators?

The Sample

The data for the 1992 validation of the Spelling Developmental Continuum were collected from 39 teachers assessing 353 students. These teachers taught either Year 1, Year 3, Year 5 or Year 7 students. They were selected from the population of Western Australian government Primary and District High schools which were known to have

[1] A poor Infit Mean Square usually means that an indicator is ambiguously worded or not tapping spelling ability as well as it might. This is explained in more detail below.
[2] An indicator with an extreme difficulty (compared with other indicators within the phase) makes it difficult for teachers to use the Continuum. Again, this is discussed below in more detail.

been formally involved with implementing First Steps. For the 1993 re-validation of the Spelling Developmental Continuum 88 teachers assessed 843 students. These students came from Kindergarten, Years 1, 3, 5 or 7 from a sample of Western Australian government primary and District High schools.

For more details of the sampling see the *Empirical validation of the First Steps Spelling and Writing Continua* and the *Empirical Re-validation of the First Steps Spelling Continuum.*

The Data

The data for the validations consisted of judgements made by teachers about the extent to which each of up to ten students in their class exhibited evidence of having demonstrated the behaviour described by each of a number of First Steps indicators.

In this report, the data consist of the results of the validations. These data are found in the appendix. (The appendix appears both as a separate document and as an attachment at the end of this report. This is done to facilitate access to the detail of the data while guarding against the possibility that a separate appendix may become lost.)

Item Response Theory (Rasch Modelling) and the validation of the Spelling Developmental Continuum

The objective of the empirical validation and the re-validation of the Spelling Developmental Continuum was to collect information about the typical order of behaviours exhibited by children as they learn to spell. This information was then compared with the order of behaviours proposed in the two versions of the Spelling Developmental Continuum.

The data for the empirical validations of the Spelling Development Continuum were analysed using the computer program 'Quest' (Adams and Khoo, 1992) which produces Item Response Theory calibrations of indicators.

The calibration process (based on the Rasch model) estimates a 'difficulty' level for each indicator. In general, the greater the number of students exhibiting the behaviour described by an indicator, the 'easier' (lower on the scale of difficulty) that indicator is estimated to be. In this way, the calibration process parallels the intention of First Steps by seeking to locate indicators at positions along a Continuum.

The calibration takes observational data supplied by teachers. These data consist of judgements made by teachers about whether their students do, or do not, exhibit the various behaviours described by the Spelling Developmental Continuum indicators. The calibration provides an estimate of difficulty for each indicator.

Once having estimated the difficulty of the Spelling Developmental Continuum indicators, the validation of the Continuum could begin. The validation involved establishing how well the indicators, ordered by the calibration process matched the order of indicators proposed by First Steps. This task is referred to as the empirical testing of the validity of the Continuum.

Exhibit 1[3] shows the calibrations for the indicators in the 1992 version of the Spelling Development Continuum. There were some problems for the Continuum revealed by these data.

The 1992 version of the Spelling Continuum had a serious overlap between the Preliminary and Semi Phonetic Phases, a less serious but noticeable overlap between the Semi Phonetic and Phonetic Phases as well as a significant overlap between the Phonetic and Transitional Phases. The developmentally later Transitional Phase had, on average, indicators which were less difficult than the Phonetic Phase.

In the 1993 version of the Spelling Development Continuum, the Transitional Phase still has, on average, easier indicators than the Phonetic Phase, however, of the overlaps between phases, only the one between the Phonetic and Transitional Phases remains. This can be seen in Exhibit 2.

It was concluded in the *Empirical Re-validation of the Spelling Development Continuum* that, because of the improved relationships between the phases, the changes made by First Steps to the Spelling Development Continuum had led to an improvement. That is, phases were more clearly delineated and so teachers would be able to locate children more precisely and consistently using the revised version.

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[3]Exhibit 1, and each of the following Exhibits, shows the data using the median to represent the measure of central tendency and the interquartile range (the central 50% of the data around the median) to represent the spread. These measures are more resistant to the effect of outliers. The data in Exhibit 1 are displayed using a type of box plot. The lower boundary of the box identifies the value above which 75% of the estimates fall and the upper boundary of the box identifies the boundary below which 75% of the estimates fall. Thus, 50% of the estimates are located between the top and the bottom of the box. The horizontal line inside the box marks the location of the median. In some boxes the median is not located centrally. In these cases the data are concentrated on the side of the box which is closer to the median. The (horizontal) width of a box is a function of the number of indicators in the phase. The more indicators there are in a phase, the wider is the box.

Exhibit 1: Box Plots of difficulty estimates of indicators within phases of the 1992 version of the First Steps Spelling Developmental Continuum

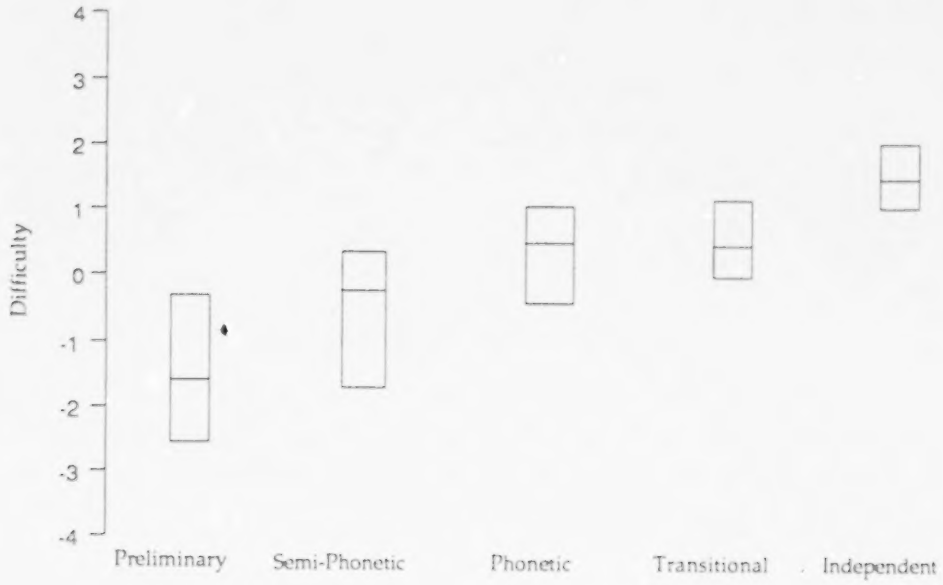
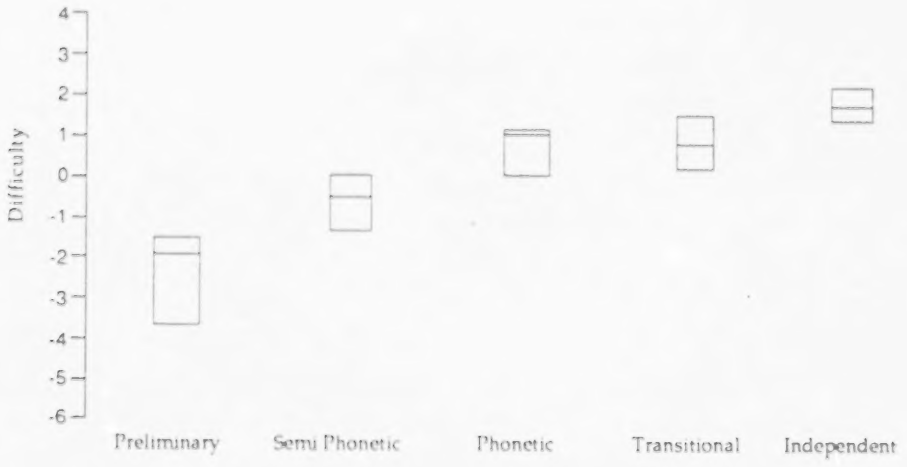


Exhibit 2: Box plots of difficulty estimates of indicators within phases of the 1993 version of the First Steps Spelling Developmental Continuum



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In First Steps, the location of a child within a phase is not established by the use of all indicators. There are certain indicators which have been defined as 'key' and it is these 'key' indicators which are used to allocate a child to a phase of development. Accordingly, it is how these key indicators are spread within phases and how much overlap there is between phases for these key indicators which is critical for establishing how reliably children will be placed into a phase. Exhibit 3 shows the estimated difficulty of key indicators within phases for the 1992 version of the Spelling Developmental Continuum. Exhibit 4 shows the same for the 1993 version. An examination of these exhibits shows considerable improvement in the 1993 version.

For the 1993 version of the Spelling Continuum there is far less overlap between phases. For example, the overlap between the Semi Phonetic and Phonetic Phases in the 1992 version (seen in Exhibit 3) is close to ideal in the 1993 version (Exhibit 4). There is also a more even spread of difficulty along the difficulty scale. This is particularly noticeable with the Semi Phonetic Phase.

Exhibit 3: Box plots overlaid with data points of the difficulty estimates of key indicators within phases of the 1992 version of the First Steps Spelling Developmental Continuum.

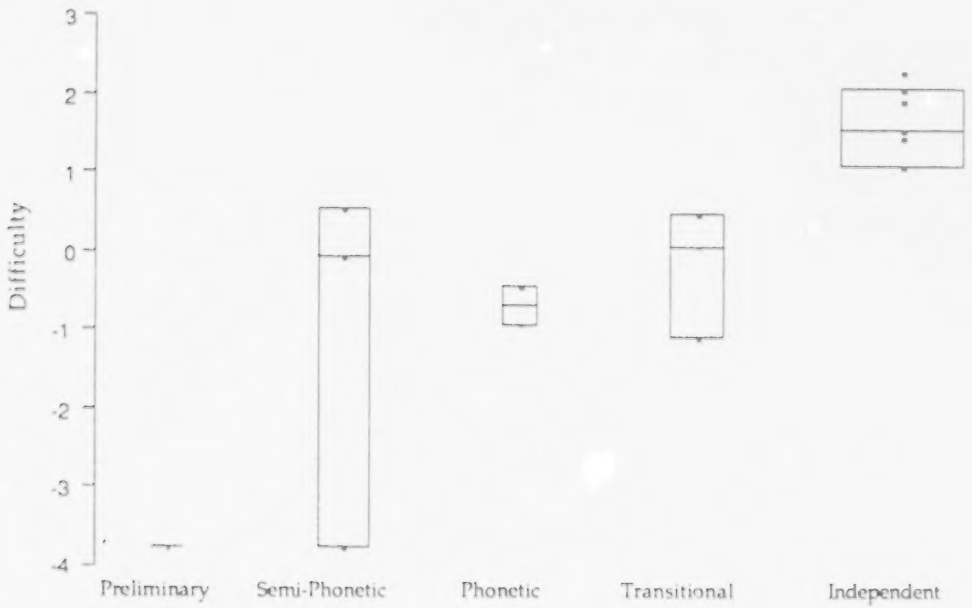

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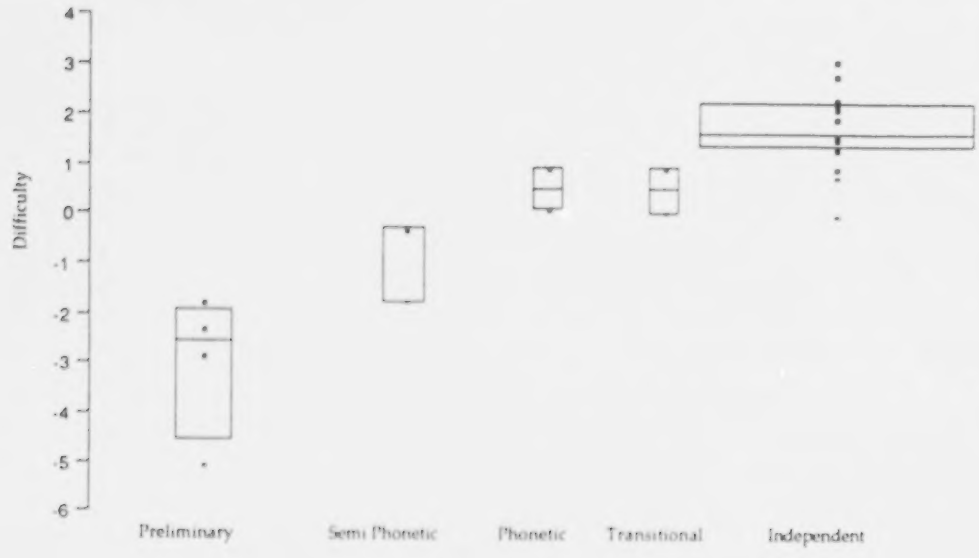
Exhibit 4: Box plots overlaid with data points of the difficulty estimates of key indicators within phases of the 1993 version of the Spelling Developmental Continuum.



There remains in the 1993 version, however, a considerable overlap between the key indicators of the Phonetic and the Transitional Phases. This means that teachers using these the key indicators from these two phases will not be able to properly identify children's level of development.

Item Response Theory also provides estimates of the extent to which an indicator is, in the case of the Spelling Development Continuum, tapping spelling ability and how consistently teachers are able to interpret an indicator. The statistic describing this estimate is the 'Infit Mean Square'.

A metaphor may help to explain this term. A First Steps Continuum can be likened to a path along which indicators are placed to act like milestones or sign posts. These milestones tell the teacher where the child is in his or her development. The Infit Mean Square might be likened to establishing how close these milestones are placed to this path. If the milestones are close to the path then their message is clear and unambiguous about a child's location. The further from the path the milestones lie, the more indistinct and ambiguous becomes their message. If they lay a long way from the path it may not be clear that they refer to this path at all but to another.

A poor Infit Mean Square can also indicate that teachers cannot consistently interpret n indicator. Often the wording is found to be ambiguous.

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Assessment of changes to the 1992 version of the Spelling Developmental Continuum

The assessment of the changes to the 1992 version of the Spelling Developmental Continuum begins by examining the differences in the number of indicators with a poor Infit Mean Square. It then examines differences in the number of indicators with an extreme estimate of difficulty compared with other indicators within the phase in which it is located.

Infit Mean Square

The Infit Mean Square is important because it provides a measure of the coherence of the continuum. The fewer indicators with a poor Infit Mean Square, the more consistently is the continuum tapping, in the case of the Spelling Continuum, spelling ability.

In the 1992 Spelling Development Continuum 15 indicators were identified with a poor Infit Mean Square. Of these 15 indicators, 2 were omitted from the 1993 version, 10 had changes made to their text and 3 were left unchanged.[4]

The 15 indicators with a poor Infit Mean Square statistic in the 1992 version are:

- Preliminary Phase: 102, 103, 106, ~~114~~, **116, 118**
- Semi Phonetic Phase ~~207~~, **216**
- Phonetic Phase **302, 303, 304, 307, 311**
- Transitional Phase **403, 406**
- Independent Phase nil

(where ~~strike through~~ means the indicator was omitted from the 1993 version, and **bold** means that the indicator was reworded for the 1993 version).

The 7 indicators with a poor Infit Mean Square statistic in the 1993 version are:

- Preliminary Phase: 102, 103, 116,
- Semi Phonetic Phase nil
- Phonetic Phase 307, <u>308</u>, <u>320</u>
- Transitional Phase <u>408</u>,
- Independent Phase nil

(where <u>underlined</u> means a poor Infit Mean Square appears only in the 1993 version).

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[4]The code numbers which follow are the numbers used for the 1992 version of the Spelling Development Continuum. Use the appendix to obtain the text of these indicators. Also use the appendix to link the 1992 code numbers to the 1993 code numbers. Only the 1992 code numbers are used in the body of the report to avoid confusion.

The following 9 indicators have an improved Infit Mean Square in the 1993 version of the Spelling Development Continuum - 106, 118, 216, 302, 303, 304, 311, 403 and 406.

Of the 10 indicators from the 1992 version which had their text changed, for the 1993 version, 8 now have a satisfactory Infit Mean Square. Of these 10, 5 had changes made only to the examples attached to the stem of the indicator (216, 304, 307, 311 and 406). This led to an improvement for all but 307. Two indicators had changes made to the stem only (116, 118) which led to an improvement for 118 but not for indicator 116. Three indicators had changes made to both the stem and the examples (302, 303 and 403) and all three indicators now have a satisfactory Infit Mean Square.

The following 3 indicators have a poor Infit Mean Square in the 1993 version but did not have a poor Infit Mean Square in the 1992 version - 308, 320 and 408. One of these indicators (308) had text changed. Perhaps this change might be reviewed.

Two of the 1992 indicators with a poor Infit Mean Square which were unchanged remain with a poor Infit Mean Square. These are indicators 102 and 103. These indicators would seem to require review, as they have now been shown, with two different sets of data collected at two points in time, to be not tapping spelling ability to a satisfactory extent. This is strong evidence that they are ambiguously worded and so teachers are unable to consistently interpret them. They probably require rewording.

Two indicators which had their text changed remain with a poor Infit Mean Square. These are indicators 116 and 307. (Indicator 116 had the stem changed and 307 had examples changed.) Changing the wording has not improved these indicators. This suggests that these indicators may not tapping spelling ability because they are misconceived. It may mean that the wording of these indicators needs to be further changed as the changes for the 1993 version were not very extensive. Alternatively, consideration should be given to omitting these indicators from the Continuum.

In general, rewording indicators with a poor Infit Mean Square has led to an improvement in the cohesion of the Spelling Development Continuum. There are fewer indicators with a poor Infit Mean Square in the 1993 version. (There were 15 in the 1992 version and 7 in the 1993 version.)

Estimates of Difficulty

Before discussing the estimates of difficulty it is important to stress, that overall, the changes made to the Spelling Continuum have led to a marked improvement in it (as judged by an Item Response Theory perspective). There are, however, a similar number of extreme estimates of difficulty in both versions. This might suggest that there has not been much improvement. An examination of Exhibits 1 and 2, and Exhibits 3 and 4, shows that there has been an improvement. This apparent anomaly occurs because outliers are defined relative to the location of other indicators within phases.

For the purposes of this report an indicator was judged to have an extreme estimate of difficulty if it fell on or beyond the 10th or 90th percentile of each Phase except for the Preliminary and the Independent Phases. In other words, an indicator has an extreme estimate of difficulty if it is too easy or too hard compares to other indicators for that phase.) For the Preliminary Phase only indicators with an estimated difficulty on or above the 90th percentile were defined as extreme. (That is, only indicators with relatively difficult estimates were defined as extreme in the Preliminary Phase.) For the Independent Phase, only those indicators with an estimated difficulty below the 10th percentile (that is, relatively 'easy') were defined as extreme. It was felt that no Preliminary Phase indicator could be regarded as too easy nor any Independent Phase indicator too difficult because these Phases are at the extremes of the Spelling Developmental Continuum. (This was providing these phases did not have a large gap between them and their adjacent phases. There were no such gaps in the 1993 version of the Spelling Developmental Continuum.)

Typically, indicators with an extreme estimate of difficulty lie within, or occassionally beyond, the range of estimates of difficulty of the indicators within an adjoining phase or phases.

There were 18 indicators with an extreme estimate of difficulty in the 1992 version of the Spelling Developmental Continuum.

The 18 indicators with an extreme estimate of difficulty in the 1992 version are:

- Preliminary Phase: 109, ~~114~~, 120
- Semi Phonetic Phase 201, 205, ~~207~~, 212,
- Phonetic Phase **304, 307, 312,** 322
- Transitional Phase **401, 403, 413,** 415
- Independent Phase 512, **513, 514,**

(where, again, ~~strike-through~~ means the indicator was omitted from the 1993 version, and **bold** means that the indicator was reworded for the 1993 version.)

The 16 indicators with an extreme estimate of difficulty in the 1993 version are:

- Preliminary Phase: 101, 120, 124,
- Semi Phonetic Phase 210, 216, 219
- Phonetic Phase 304, 312, 317, 322
- Transitional Phase 401, 409, 411, 415
- Independent Phase 512, 514

(where under lined means an extreme difficulty estimate appears only in the 1993 version.)

The following 8 indicators, which had an extreme estimate of difficulty in the 1992 version, show an improvement in the 1993 version - 109, 201, 205, 212, 307, 403, 413 and 513.

The following indicators did not have extreme estimates of difficulty in the 1992 version, but do have in the 1993 version; 101, 124, 210, 216, 219, 317, 409 and 411. Of these indicators, 216, 317, 409 and 411 had their text changed for the 1993 version. The revised text may need to be re-examined for these indicators.

Of the 18 indicators identified in the 1992 version of the Continuum 2, were left out of the 1993 version, 8 had their text changed and 8 were left unchanged. Of those indicators which had their text changed, 4 indicators show less extreme estimates of difficulty in the 1993 version. Of the 8 of indicators which were left unchanged, 4 assumed less extreme values in the 1993 version.

Of particular interest are those indicators which have extreme estimates of difficulty in both versions of the Spelling Continuum. These indicators should be carefully examined. The indicators 120, 322, 415 and 512, which are extreme in both versions of the Continuum, were not reworded. It is suggested that the wording of these indicators be examined. The indicators 304, 312, 401 and 514 have extreme estimates of difficulty despite rewording for the 1993 version. It may be that these indicators need to be moved to other phases or, perhaps, omitted from the Continuum.

In general, the changes to the 1992 version of the Spelling Developmental Continuum have not lead to much of a reduction in the number of indicators with an extreme estimate of difficulty. (The number has gone from 18 to 16.) However, there has been an overall improvement in the characteristics of the Spelling Developmental Continuum. This can be seen when comparing Exhibits 1 and 2 and, for the key indicators, Exhibits 3 and 4. This suggests that the rewording of the indicators has led to a better clustering of indicators within phases. It should be noted that this rewording has not removed the problem of the overlap between the Transitional and Phonetic Phases.

A summary of the indicators which may need further revision in the 1993 version of the Spelling Developmental Continuum

The following indicators should be revised or considered for exclusion because they have a poor Infit Mean Square in both the 1992 and 1993 versions of the Spelling Developmental Continuum:

102, 103, 116, 307

Indicators 102 and 103 had no changes made for the 1993 version, and so rewording may improve them. Indicators 116 and 307 remain a problem despite rewording. They may be candidates for exclusion from the continuum. As a minimum they should be reviewed for consistency of content with other indicators for that same phase, and checked for possible ambiguity.

The following indicators have a poor Infit Mean Square in the 1993 version and if this version is to be adopted then these indicators may need to be further examined;

308, 320, 408

The following indicators have extreme estimates of difficulty in both the 1992 and 1993 versions of the Spelling Developmental Continuum;

120, 304, 312, 322, 401, 415, 512, and 514.

All of these indicators had their wording changed. They have remained extreme despite these changes which suggests that they may represent skills that are more consistent with another phase. They may need, therefore, to be moved to another phase. Alternatively, they may need to be removed from the Continuum.

The following indicators have extreme estimates of difficulty in the 1993 version. They may require further consideration;

124, 210, 216, 219, 317, 409 and 411.

Conclusion

In general, the changes made to the 1992 version of the Spelling Developmental Continuum have led to more coherence in the Continuum. It would be expected that as a result teachers would be able to use the Spelling Developmental Continuum more consistently and more easily. As well, despite there not being much difference in the number of indicators with an extreme estimate of difficulty in the 1992 and 1993 versions of the Spelling Developmental Continuum, changes to the indicators have led to an improved ordering of the indicators. This improvement is especially important with the key indicators. Given that many of the changes in the 1992 version of the Spelling Developmental Continuum were as a result of findings from the empirical validation, the improvements seen in the 1993 version, may be attributed, at least in part, to the use of Item Response theory as a tool to inform this revision.

Bibliography

Adams, R and Khoo, S. Quest, Hawthorn, Victoria, ACER, 1992.

Australian Council for Educational Research Empirical Validation of the First Steps Spelling and Writing Continua, Hawthorn, Victoria, 1993.

Australian Council for Educational Research Empirical Re-validation of the First Steps Spelling Continuum, Hawthorn, Victoria, 1993.

Western Australian Ministry of Education, Spelling Developmental Continuum, Perth, 1992

Appendix: Code numbers and text for Spelling Continuum indicators: 1992 and 1993 version, identifying poor Infit Mean Square and extreme estimates of difficulty

This Appendix lists the code numbers and text for both the 1992 and the 1993 versions of the Spelling Developmental Continuum. It also provides information about the Infit Mean Square and whether an indicator has an extreme estimate of difficulty. The data for the 1992 version come from the *Empirical validation of the First Steps Spelling and Writing Continua* report. The data for the 1993 version come from the *Empirical re-validation of the First Steps Spelling Continuum* report.

The body of the appendix consists of a table with 9 columns. The table is broken up into five sections - one for each of the Phases within the Spelling Developmental Continuum.

The first column of the table lists the code number for the indicators of the 1992 version of the Continuum. These are the same numbers as those used in the *Empirical validation of the First Steps Spelling and Writing Continua* report. The table is ordered by these numbers.

The second column lists the text of each of the indicators of the 1992 version of the Spelling Developmental Continuum.

The third column describes how satisfactory the Infit Mean Square was estimated to be in the 1992 validation study. Cells in the column are left blank where the Infit Mean Square was satisfactory. The word 'Poor' indicates that this indicator was judged to not be satisfactorily tapping spelling ability. or was ambiguous. The words 'Left out' show that the indicator was omitted from the analysis because either all students or no students exhibited the behaviour described by the indicator. When this happens an estimate of difficulty cannot be calculated. (No indicators were 'left out' of the 1993 re-validation.)

The fourth column describes how well the estimated difficulty of an indicator matched the difficulty of other indicators within the phase. Where a cell in this column is blank, the indicator has a similar degree of estimated difficulty to other indicators within its phase. The other two entries in this column are 'Too easy' and 'Too hard'. These entries point out that these indicators have an extreme estimate of difficulty when compared with other indicators within the phase.

The fifth column indicates if the text of an indicator from the 1992 version was changed. A blank cell means there was no change.

The sixth column lists the code numbers for the indicators in the 1993 version of the Spelling Developmental Continuum. These are the code numbers used in the *Empirical re-validation of the First Steps Spelling Continuum* report. Occasionally the word 'omitted' appears in this column. This indicates that this indicator which appeared in the 1992 version was omitted from the 1993 version. (Note that this is different from those indicators which were 'left out' of the validation in 1992 because all or no students exhibited the behaviours.)

The seventh and eighth columns provide the same information as the third and fourth columns, except that the information comes from the 1993 re-validation. This information can be found in the *Empirical re-validation of the First Steps Spelling Continuum* report.

The ninth column lists the text of an indicator which was changed for the 1993 re–validation. Indicators which appear for the first time in the 1993 version are also listed in this column. A blank cell in this column means that the wording of the indicator was the same in the 1992 and 1993 versions.

Finally, it should be noted that not all changes made to the 1992 version of the Spelling Developmental Continuum can be attributed to the ACER validation. All indicators which had text changed and had either a poor Infit Mean Square or an extreme estimate of difficulty, were changed as a consequence of the 1992 validation study. Some text was changed even though the validation found no problems with the indicator. For more detailed information, see Appendix D in the *Empirical re-validation of the First Steps Spelling Continuum* report, which lists all indicators changed as a consequence of the validation.

The page numbers for the tables begin with page 6 to keep the numbering consistent with the separately published Appendix.

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
1. Preliminary Phase		Infit Mean Sq.	Difficulty	New Text ?	New Code	Infit Mean Sq.	Difficulty	New Text
101	draws symbols that resemble letters using straight, curved, intersecting lines				1104		Too easy	
102	uses a combination of pictorial and letter representations	Poor			1105	Poor		
103	places letters randomly on a page	Poor			1106	Poor		
104	mixes letters, numerals and invented letter shapes				1107			
105	repeats some known alphabet symbols (often uses letters from own name)				1108			
106	writes random strings of letters	Poor			1109			
107	uses writing-like symbols to represent written language	*Left out*			1110			
108	uses known letters or approximations of letters to represent written language	*Left out*			1111			
109	assigns a message to own symbols		Too easy		1112			
110	shows beginning awareness of directionality				1113			

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
1. Preliminary Phase (Continued)		Infit Mean Sq.	Difficulty	New Text ?	New Code	Infit Mean Sq.	Difficulty	New Text
111	knows that writing and drawing are different	*Left out*			1102			
112	knows that a word can be written down	*Left out*			1103			
113	is aware that print carries a message				1101			
114	may read own writing differently at each reading	Poor	Too hard		*Omitted*			
115	recognises own name or part of it, (e.g. 'That letter is in my name')			Yes	1114			recognises own name or part of it, e.g. Stephen says "That's my name" looking at 'Stop'
116	writes the first letter of name correctly and finishes the word with a random string of letters	Poor		Yes	1115	Poor		writes the first one or two letters of own name or word correctly and may finish with a random string of letters
117	writes own name correctly				1116			
118	names or labels own writing and pictures using a variety of symbols	Poor		Yes	1117			names or labels own 'writing' and pictures using a variety of symbols
119	reacts to environmental print				1118			

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
1. Preliminary Phase (Continued)		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
120	is willing to 'have a go' at representing speech in print form		Too hard		1119		Too hard	
121	experiments with writing-like forms			Yes	1120			enjoys experimenting with writing-like forms
122	talks about what has been drawn, written			Yes	1121			talks about what has been 'written' or drawn
123	asks questions about printed words and messages			Yes	1122			asks questions about printed words, signs and messages
124	is keen to share written language discoveries with others				1123		Too hard	

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
2. Semi Phonetic Phase		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
201	uses left to right and top to bottom orientation of print		Too easy		1201			
202	relies heavily on the most obvious sounds in a word, e.g. KT (kitten) WT (went) BE (baby)			Yes	1202			relies on the sounds which are most obvious to him or her. This may be the initial sound; initial and final sounds, or initial medial and final sounds, e.g. D (down),DN (down), DON (down),KT (kitten), WT (went), BAB (baby), LRFT (elephant)
203	represents a whole word with one, two or three letters. Uses mainly consonants, e.g. KGR (kangaroo) BT (bit)				1203			
204	uses an initial letter to represent most words in a sentence, e.g. s o i s g t o c a s (Someone is going to climb a slide)				1204			
205	uses letter names to represent sounds, syllables or words e.g. AT (eighty)		Too hard		1205			
206	uses a combination of consonants with a vowel related to a letter name, e.g. GAM (game), MI (my)				1206			

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
2. Semi Phonetic Phase (Continued)		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
207	uses more letters for longer words	Poor	Too hard		*Omitted*			
208	writes one or two letters for sounds then adds random letters to complete the word, e.g. crecuea (creature)			Yes	1207			writes one or two letters for sounds, then adds random letters to complete the word, e.g. greim (grass), rdms (radio)
209	begins to use some simple common letter patterns, e.g. th (the), bck (bike)				1208			
210	uses a small bank of known sight words correctly				1209		Too easy	
211	recognises some sound-symbol relationships in context, e.g. points to 'ship' and says 'sh' or recognises first letter of name				1210			
212	recognises some words in context, e.g. 'That word says "dog".'		Too easy		1212			
213	recognises rhyming words				1213			
214	recognises and copies words in the environment				1214			

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
2. Semi Phonetic Phase (Continued)		Infit Mean Sq.	Difficulty	New Text ?	New Code	Infit Mean Sq.	Difficulty	New Text
215	begins to leave spaces between word-like letter clusters, e.g. I h bn sik (I have been sick)			Yes	1215			leaves spaces between word-like letter clusters, e.g. I h bn sik (I have been sick)
216	confuses words with objects they represent, e.g. 'Train is a long word because trains are long, caterpillar is a little word because...'	Poor		Yes	1216		Too hard	confuses words with objects they represent, e.g. "Train is a long word, 'cos trains are long. Butterfly is a little word...."
217	is willing to have a go at representing speech in a print form				1217			
218	is confident to experiment with words				1218			
219	talks about what has been drawn, written				1219		Too easy	
220	seeks response by questioning				1220			
221	is keen to share written language discoveries with others				1221			
					1211	*New Indicator*		knows the letters of the alphabet by name

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
3. Phonetic Phase		Infit Mean Sq.	Difficulty	New Text ?	New Code	Infit Mean Sq.	Difficulty	New Text
301	chooses letters on the basis of sound without regard for conventional spelling patterns, e.g. kaj (cage), tabl (table), birgla (burglar)			Yes	1301			chooses letters on the basis of sound without regard for conventional spelling patterns, e. g. kaj (cage), tabl (table), birgla (burglar), vampia (vampire), pepl (people), sum (some), bak (back)
302	develops particular spellings for certain sounds often using self-formulated rules, e.g. becoz (because), woz (was)	Poor		Yes	1303			develops particular spellings for certain sounds often using self formulated rules, e.g. becoz (because)/woz (was), wher (were)/whas (was), dor (door)/ sor (saw)/mor (more), hape (happy)/fune (funny), poot (put)/wood (would)
303	substitutes incorrect letters for those with similar pronunciation, e.g. oshan (ocean), nacher (nature)	Poor		Yes	1304			substitutes incorrect letters for those with similar pronunciation, e.g. oshan (ocean), nacher (nature), wold (world), heard (herd), disobays (disobeys), consert (concert), butiful (beautiful), tuched (touched), daw (door), tresher (treasure), thort (thought)

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
3. Phonetic Phase (Continued)		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
304	adds an incorrect vowel after a correct vowel or consonant, e.g. hait (hat), derum (drum), miu (my), fien (fine)	Poor	Too hard	Yes	1305		Too hard	adds an incorrect vowel after a correct vowel or consonant, e.g. hait (hat), derum (drum), miu (my), Fiene(fine), saeid (said), beofore (before), seing (sing)
305	represents past tense in different ways according to the sounds heard, e.g. stopt (stopped), watcht (watched), livd (lived)				1306			
306	uses the letter 'r' to represent a syllable, e.g. watr (water), mothr (mother)				1307			
307	confuses short vowel sounds, e.g. pell (pill)	Poor	Too hard	Yes	1308	Poor		confuses short vowel sounds, e.g. pell (pill), yallow (yellow), u (a), pan (pen), lat (let), sow (saw)
308	sometimes omits one letter of a two letter blend or digraph, e.g. fog (frog), mik (milk), leve (leave)			Yes	1309	Poor		sometimes omits one letter of a two letter blend or digraph, e.g. fog (frog), mik (milk), leve (leave), plak (plank)
309	chooses letters on the basis of sound, e.g. vampia (vampire), pepl (people)				*Omitted*			

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
3. Phonetic Phase		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
310	represents all the essential sounds of a word, e.g. spidr (spider), kitn (kitten), wacht (watched)			Yes	1302			sounds out and represents all substantial sounds in a word, e.g. ktn (kitten), wacht (watched), anathe (another), aftrwoods (afterwards), siclon (cyclone) spidr (spider), isgrem (ice cream), necst (next), peepl (people)
311	still uses some letter name strategies, e.g. awa (away), exellnt (excellent)	Poor		Yes	1310			still uses some letter name strategies e.g. awa (away), exellnt (excellent), mit (might), lrst (last), cav (cave)
312	usually spells commonly used sight words correctly, e.g. in, has, his, he, m		Too easy	Yes	1312		Too easy	usually spells commonly used sight words correctly, e.g. in, has, his, he, my, the, here
313	uses some known patterns in words, e.g. mathursday (mothers' day), nght (night)			Yes	1313			uses some known patterns in words, e.g....ing, th..., sh..., nght (night)
314	is beginning to use syllabification for spelling longer words, e.g. telefon (telephone), butufl (beautiful). Some syllables may be omitted.				1314			
315	shows increased influence of spelling words encountered in books			Yes	1317			applies knowledge which has been gained from reading and words encountered in books, e.g. pirate, ship

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
3. Phonetic Phase (Continued)		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
316	identifies similar sounding words			Yes	1315			identifies and uses knowledge of similar sounding words
317	is beginning to use simple homonyms/homophones correctly, e.g. their/there, one/won, for/four, two/too/to, park, nail			Yes	1318		Too hard	is beginning to use simple homonyms and homophones correctly, e.g. wind, read, park, their/there, one/won, for/four, too/to
318	continues to 'have-a-go'—experimenting with spelling words in different ways				*Omitted*			
319	is willing to 'have a go' at representing speech in print form				1319			
320	sees self positively as a writer - speller				1320	Poor		
321	confidently makes decisions				1321			
322	is willing to spell on his/her own		Too easy		1322		Too easy	
323	uses word sources confidently				1323			

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
3. Phonetic Phase		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
					1311			*New indicator:* creates some words by combining known sight words and patterns e.g. apreesheeight (appreciate), jenyouwine (genuine), MaThursday (Mother's Day)
					1316			*New indicator:* experiments with spelling words in different ways

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
4. Transitional Phase		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
401	uses common English letter sequences, when attempting to spell unknown words, e.g. thousend (thousand), cort (caught), doller (dollar)		Too easy	Yes	1403		Too easy	uses visual knowledge of common English letter sequences when attempting to spell unknown words e.g. thousend (thousand), cort (caught), doller (dollar)
402	uses vowel digraphs liberally - may be unsure of correct usage, e.g. plaiyed, kaingarows, rane			Yes	1404			uses vowel digraphs liberally, but may be unsure of correct usage, e.g. plaiyed (played), kaingarows (kangaroos), ailyen (alien)
403	uses silent 'e' as an alternative for spelling long vowel sounds—may be over-generalised, e.g. mite (might), biye (buy)	Poor	Too hard	Yes	1405			may have over-generalised the use of silent 'e' as an alternative for spelling long vowel sounds e.g. mite (might), biye (buy), chare (chair), moste (most), rane (rain), growe (grow), ocaye (okay)
404	correctly inserts a vowel before the 'r' at the end of a word, e.g. 'brother' instead of 'brothr'; 'water' instead of 'watr'			Yes	1406			syllabifies and correctly inserts a vowel before the 'r' at the end of a word, e.g. 'brother' instead of 'brothr', 'water' instead of 'watr'
405	spells inflectional endings such as '-s', '-ing', '-est', conventionally			Yes	1407			spells inflectional endings such as ...tion, ...ious, ...ight, ...ious conventionally
406	includes all the correct letters but may sequence them incorrectly: yuo (you), shose (shoes)	Poor		Yes	1408			includes all the correct letters but may sequence them incorrectly, e.g. yuo (you), shose (shoes), Micheal (Michael),thier (their), recieve (receive)

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
4. Transitional Phase (Continued)		Infit Mean Sq.	Difficulty	New Text ?	New Code	Infit Mean Sq.	Difficulty	New Text
407	beginning to make spelling generalisations (uses some double letters correctly)				1409			
408	is able to proof read known bank of words				1410	Poor		
409	uses letters to represent all vowel and consonant sounds in a word, placing vowels in every syllable, e.g holaday (holiday), gramous (grandma's), honeted (hunted)			Yes	1401		Too easy	uses letters to represent all vowel and consonant sounds in a word, placing vowels in every syllable, e.g. holaday (holiday), gramous (grandma's), castel (castle), replyd (replied), gorrilas (gorillas), picture, dinosaur, spaghetti
410	is beginning to use visual strategies, such as knowledge of common letter patterns and critical features of words, e.g silent letters, double letters				1402			
411	is beginning to use knowledge of word meanings, e.g. sign - signature, medicine - medical, useually (usually)			Yes	1411		Too hard	is beginning to use knowledge of word meanings, e.g. sign/signature, medicine/medical, circle/circular
412	usually represents all syliables when spelling a word, e.g. uncontrollablely (uncontrollably)				1412			

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
4. Transitional Phase (Continued)		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
413	has a bank of known words that are used in writing		Too easy	Yes	1413			is extending bank of known words that are used in writing, including some subject specific words, e.g. February, Christmas, restaurant, diameter, conservation, scientific
414	is beginning to use knowledge of word parts, e.g. prefixes, suffixes, compound words				1414			
415	uses more difficult homonyms/homophones correctly, e.g. sore/soar; pour/poor, board/bored		Too hard		1415		Too hard	
416	is willing to take risks and responsibility				*Omitted*			
417	is willing to 'have a go' at spelling difficult words, e.g. abitories (abattoir)				1416			
418	is aware of social obligations as a speller				1417			
419	is willing to use a range of resources				1418			
420	has an interest in words and enjoys using them				1419			

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
5. Independent Phase		Infit Mean Sq.	Difficulty	New Text ?	New Code	Infit Mean Sq.	Difficulty	New Text
501	is aware of the many patterns and rules that are characteristic of the English spelling system, e.g. common English letter patterns; relationship between meaning and spelling				1501			
502	makes generalisations and is able to apply them to new situations, e.g. rules for adding suffixes, selection of appropriate letter patterns (-tion)				1502			
503	has mastered accurate spelling of prefixes, suffixes, contractions, compound words				1503			
504	uses context to distinguish homonyms and homophones				1504			
505	uses silent letters and double consonants correctly*(Note that no data were collected for this indicator owing to error in computer program.)*				1505			
506	continues to master words with uncommon spelling patterns and words with irregular spelling, e.g. eight, aisle, quay			Yes	1506			continues to master words with uncommon spelling patterns and words with irregular spelling, e.g. aisle, quay, liaise

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
5. Independent Phase (Continued)		Infit Mean Sq.	Diffic-ulty	New Text ?	New Code	Infit Mean Sq.	Diffic-ulty	New Text
507	uses less common letter patterns correctly, e.g. weird, forfeit, cough, reign				1507			
508	uses a multi-strategy approach to spelling (visual patterns, sound patterns, meaning)				1508			
509	is able to recognise when a word doesn't look right and to think of alternative spellings			Yes	1509			is able to recognise if a word doesn't look right and to think of alternative spellings
510	analyses and checks work, editing, writing and correcting spelling				1510			
511	recognises word origins and uses this information to make meaningful associations between words				1511			
512	continues to experiment when writing new words		Too easy		1512		Too easy	
513	uses spelling references (dictionaries, thesauruses, resource books) appropriately		Too easy	Yes	1513			uses spelling references such as dictionaries, thesauruses and resource books appropriately
514	uses syllabification when spelling new words, e.g. illeagle (illegal)		Too easy	Yes	1514		Too easy	uses syllabification when spelling new words

1992 Version of the Spelling Continuum					1993 Version of the Spelling Continuum			
5. Independent Phase (Continued)		Infit Mean Sq.	Difficulty	New Text ?	New Code	Infit Mean Sq.	Difficulty	New Text
515	has accumulated a large bank of known words (is using more sophisticated language)			Yes	1515			has accumulated a large bank of known sight words and is using more sophisticated language
516	shows increased interest in the similarities, differences, relationships and origins of words				1516			
517	is willing to take risks and responsibility - is aware of social obligations as a speller			Yes	1517			is willing to take risks and responsibilities and is aware of a writer's obligations to readers in the area of spelling
518	has a positive attitude towards self as a speller				1518			
519	has an interest in words and enjoys using them				1519			
520	is willing to use a range of resources			Yes	1520			is willing to use a range of resources and extend knowledge of words, including derivation, evolution and application